ABSTRACT

Apparatus, system and method for precisely and quickly controlling the flow of molten metal to metal-casting apparatus, either by pumping or by braking or throttling. The Faraday-Ampère electromagnetic principle of current flow in a unidirectional magnetic field is employed, wherein Faraday's three-finger rule shows pumping direction or throttling direction. Permanent magnets comprising neodymium or similar high-energy, rare-earth materials provide a unique "reach-out" magnetism. These neo-magnets, usually shown as cubes, are arranged in various powerful configurations for driving an intense unidirectional magnetic field B across a non-magnetic gap many times larger than is economically feasible otherwise. This gap accommodates a conduit for pressurizing and moving a flow of molten metal. Molten metal may be pumped to a distributor or a siphon at an entrance to a metal-casting machine. Alternatively, an unconstrained parabolic jet-fountain-stream of molten metal is projected through an inert atmosphere directly into such a machine, thereby avoiding need for long passageways containing fragile refractories for channelling molten metal flows. In making multiple identical castings, the invention enables a controlled, intermittent, predetermined flow of molten metal to be fed to a series of identical individual molds. Among its advantages are that the invention obviates needs for servo-operating metallurgical valves or expensive tilting mechanisms for metallurgical furnaces. Existing furnaces which are too low to permit flow by gravity to a point of casting may be rendered usable by embodiments of this invention.

[243 words]